

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

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* RADIATION PROBLEMS FOR SUPERSONIC FLIGHT

Future supersonic commercial transport aircraft may be required to alter flight plans due to cosmic radiation, in much the same way as present-day airliners avoid severe weather. Earth satellite observations may be required for radiation warning purposes.

✓ Hazard vs. Latitude -- G. P. Bates, Jr. of Headquarters, National Aeronautics and Space Administration, discussing operational problems of the proposed supersonic transport (SST), states that natural radiation does not appear to pose any hazards for crew or passengers cruising at latitudes below 50° geomagnetic. For latitudes above 50° geomagnetic, the hazard is said to be "an infrequent one" because of proton events related to solar flares. However, certain precautions will be necessary.

✓ High Energy Intensity -- Solar flares producing high energy proton events occur with a maximum of one or two every four years -- but can occur in fairly rapid succession. Bates suggests that occupants of an aircraft at 75,000 feet could be subjected to a significant dosage rate -- "not necessarily detrimental but (as) high as you would wish to allow for passengers and, more particularly for the crew which might be subjected to repetitive dosage."

✓ Operating Possibilities -- Several alternatives are being studied for use in cases where such high energy events occur:

∅ The aircraft can proceed to its destination if its crew has not previously encountered medium- or high-energy proton events during the year (which is the most likely probability.

∅ To be completely safe, the SST can descend to 50,000 feet for the remainder of the flight, so that the shielding effect of the atmosphere serves to drastically reduce the radiation dosage rate.

∅ The vehicle might also change its flight path to get back under the protection of the earth's magnetic field.

✓ Radiation Warning Systems -- By the time the SST is flying, improved knowledge of solar flares may permit weather-type "forecasts". If this can be done, the flight plan which keeps the aircraft under the magnetic shield of the earth could be chosen in advance. As an example, there should be no transpolar flights under such conditions. Flare occurrence, Bates points out, can easily be detected by solar patrols on earth, by instrumentation on board the SST, or by satellites around the earth which are monitoring x-radiation wave lengths.

✓ "Operational Problem" -- Proton events occur infrequently, the NASA official emphasizes, and do not always follow a solar flare. However, "they will be considered as an operational problem for the supersonic transport in the same way as severe weather is now considered for commercial aviation."

* NAVY DEVELOPS NOVEL UNDERWATER SOUND SOURCES

Navy investigators envision a number of military and commercial potentialities in two different types of high-intensity, low frequency sound sources. These are:

Ø Underwater Spark Sound Source

- ✓ The principle of this development has been known for some time. An underwater electrical discharge causes a sharp increase in temperature of water between the electrodes. The water vaporizes and forms a gas bubble which expands and collapses - and radiates acoustic waves.
- ✓ Application studies show this type of source is suitable for explosive echo ranging, particularly from a submarine -- and shows promise as a source for long-range, active detection and for long-range underwater signaling.
- ✓ Advantages of this type of source are said to be many. The underwater spark is safer than chemical explosives, according to the Navy. And unlike such explosives, the signals can be repeated. The spark is said to be simple, reliable and easily adapted to working at great depths. The short-duration pulse is also too short to "home on," and is said to allow discrimination against reverberation.
- ✓ Future studies, recommended by the Navy investigators, include tests to determine whether the underwater spark system can be used for converting existing passive coastal defense systems into active systems; converting existing submarine passive equipment into active echo-ranging equipment; and for other possible applications in fields of oceanography, hydrography and seismology.

Ø Pneumatic Sound Source

- ✓ The principle of this development also appears to be rather simple. An elastic sphere is inflated under water until its expansion limit is exceeded and it ruptures. The resulting air bubble alternately expands and contracts -- providing a wave train at the resonant frequency of the bubble.
- ✓ The frequency of a given bubble size is controlled by the stiffness of the medium, which is proportional to depth. Therefore the frequency of oscillation can be controlled, as was demonstrated in thousands of pneumatic explosions, in which frequencies between 5 and 300 cycles per second were generated.
- ✓ Advantages are said to include control, as outlined above, and simplicity. In its lightest form this generator weighs less than one pound -- but has been demonstrated a peak acoustic level of over 4000 watts for a nondirectional condition.
- ✓ Future applications under consideration include ASW operation; conversion of coastal defense passive systems into active systems; explosive echo ranging; mine countermeasures; anti-limpeteer operations; and coded signaling. Typical commercial applications, according to the Navy, could be geophysical prospecting and explosive metal forming. There may be additional applications requiring a single pulse of selected frequency within its operating band.

Ø Other Novel Sound Sources

- ✓ Conversion of heat to sound has also been studied, in the hope that the abundance of heat available in nuclear submarines might be utilized. In one simple experiment dry ice, at about -110°F changes from a solid to a gas. If a metal object which is at or near room temperature, is brought into contact with the dry ice it imparts considerable heat. This causes release of gas, considerable pressure at the point of contact, and vibration at various frequencies and "surprisingly" high levels. Another experiment makes use of a phenomenon known as a "wolf tone" -- a sympathetic resonance between a vibrating body and a resonant chamber.

(Details from the U. S. Navy Electronic Laboratory, San Diego, Calif. available in Report AD 260 282. 61 Pages. \$6.60 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)

* ARMY RESEARCH PROBLEMS (Continued from WST, November 27, 1961)

- QMC - 184 -- Develop packaging materials and methods to protect ferrous metal repair parts against the deleterious effects of rust and corrosion. (Under present packaging methods, ferrous metal repair parts are protected against rust and corrosion by applying a preservative compound directly on the part, by using a volatile corrosion inhibitor which is applied by impregnation of barrier materials, or induced directly into the atmosphere within the package. The part is then enclosed in a material which acts as a moisture barrier. There is a need for packaging methods which will eliminate the necessity for applying preservatives directly on repair parts, or the necessity for using volatile corrosion inhibitors. Elimination of preservative compounds will simplify prepackaging preservation procedures and eliminate the time-consuming and costly de-preservation operations which are necessary before the parts may be used. A material which will satisfy this need must be capable of being formed around irregular contours, provide protection against water vapor and oxygen penetration, and be sufficiently durable to withstand handling stresses encountered in storage and distribution systems. Transparency is a desirable characteristic to facilitate identification of parts and expedite surveillance inspection procedures. The packaging material must be easily removable without special equipment or materials.)

- QMC - 185 -- Develop technical requirements for folding and non-folding grades of boxboard having special properties such as (1) greaseproofness, (2) water-proofness, and (3) water vapor permeability resistance. (Presently, where a greaseproof pack is required, for example in packaging various spare parts, the item to be packaged is degreased, cleaned, coated with a suitable preservative, wrapped in greaseproof paper, and placed in the interior carton or box. To waterproof this box, the present practice is to overwrap the item with paper or scrim material, after which the overwrapped interior container is dipped in wax. This current procedure is time-consuming, expensive, and requires depreservation of the item prior to use.

During the past few years, industry has developed various grades of boxboard having one or more of the required properties. However, there is no means currently available to government agencies for purchasing such materials other than by brand names or by having an intimate knowledge of the boxboard industry. Therefore, the development of performance requirements for these board types will be of considerable assistance to military, as well as many civilian agencies of the government.)

- QMC - 33 -- Develop insecticidal chemicals, biological agents, insect attractants, repellents and/or other procedures for the protecting of personnel, material, and real property against insect attack. (All but two of the principal insects attacking man in military situations have developed resistance to one or more insecticides. All insecticides in common use for protection of military personnel and property have engendered insecticide resistance in one or more species of insects. Certain insects, such as the housefly, in some areas cannot be controlled by any of the insecticides in current use. Development of new insecticides on the basis of current knowledge and developmental philosophy cannot be expected to produce any lasting change in the situation. There is an urgent need for new insect control methods which do not rely upon highly toxic chemicals.

Insect hormones have been shown to be capable of interfering with normal development of insects causing them to die eventually. Either hormones, their analogs, or their antimetabolites could conceivably be used for control purposes.

Insect attractants, including naturally occurring insect secretions and their analogs, have a potential for use in attracting insects to specially baited traps.

* ARMY RESEARCH PROBLEMS (Continued)

Lindane can be used instead of naphthalene to protect boxed woollens against moths. The quantities of lindane used are much less than those of naphthalene; the protection afforded is greater and lasts much longer; and use of lindane eliminates the costly annual inspection required for naphthalene. A process is needed for application of lindane to packaging liners in a fashion suitable to military requirements.

Bacteria and viruses have been used successfully for the control of lawn and forest insects. Other bacteria are now being evaluated for possible use in controlling insects on certain food crops. More information is needed to determine whether bacteria and viruses may be used to effective control insects which adversely affect military operations, including disease vectors, and food- and material-infesting insects.

There is a requirement for data concerning insect problems which may be involved in icecap operations to determine: (1) what insect infestations may occur on men living in restricted quarters or in the quarters themselves when established on or in the icecap; (2) what noxious or food infesting insects may be imported with materiel shipped into icecap operational areas; and, (3) whether any structural pests could cause damage under such rigorous environmental conditions.)

- QMC - 34 -- Develop a lightweight expendable pallet. (A lightweight expendable pallet having the following characteristics is required:

- a. Overall top deck area of 40" by 48";
- b. Minimum bottom deck or post area of 40 percent of the overall top deck area;
- c. Weight, substantially less than 75 pounds;
- d. Minimum 4-way entry for handling by forklift and hand pallet trucks;
- e. Minimum dynamic capacity of 2,500 pounds;
- f. Minimum static capacity of 10,000 pounds each. Must support three additional loaded units in a tier.
- g. Cost, materially less than \$3.00 each, in quantity;
- h. Resistance to handling and shipping stresses with a capability for being handled a minimum of 16 times when loaded;
- i. End posts or supports set in from 40" and/or 48" sides a minimum of 2½" for slinging purposes;
- j. Capability for the application of load-securing straps encircling the load and pallet in two vertical planes, so as not to interfere with or be affected by handling equipment.
- k. Nestability as a group, and/or minimum storage cubage;
- l. Minimum number of similar and different parts;
- m. Minimum tools and time requirement for assembly so that "knock-down" pallets may be assembled in the field.
- n. Relatively non-slipping surfaces when dry or wet;
- o. Minimum of protruding parts and sharp edges;
- p. Resistance to moisture, acids, oils, corrosion, insects, fungus, deterioration from exposure to the elements, or other deteriorative agents.
- q. Capability for withstanding prolonged exposure to temperatures ranging from -60° F. to +125° F.)

- QMC - 32 -- Compile and evaluate ozone-climatology data to minimize deterioration of elastomeric materiel stored in military warehouses. (Little is known of the climatology and meteorology of surface air ozone concentrations. Sporadic studies have been conducted with a variety of instruments, and these data should be collected and evaluated. Additional data need to be taken at a number of locations throughout the world with the improved instrumentation recently developed. Data from these observations then need to be analyzed to present a picture of the world-wide climatology of ozone and the meteorological and cultural processes responsible for its formation. In particular, measurements need to be taken and evaluated for warehouses where equipment with rubber components are stored for long periods, and this information used to determine quantitative effects of ozone on rubber deterioration.)

* ARMY RESEARCH PROBLEMS (Continued)

- QMC - 23 -- Develop improved flexible films and laminated flexible materials. (When polymeric substances are irradiated, fragments of the polymer are produced. These fragments are odorous and possess flavors which are imparted to the food. The presence of these substances is objectionable; therefore, a need exists for:

✓ An additive or means of treating plastic packages to stabilize them so that short chain fragments are not formed during irradiation.

✓ An additive or means of treating plastic packages which will fix or anchor short chain fragments within the container wall and prevent diffusion or leaching of the fragments into the food.

When plastic packages containing foods are stored at elevated temperatures (100° F.) some food chemicals such as lactic acid and various types of fats promote stress cracking of the package. This is objectionable since it results in failure of the container and in the case of sterile foods permits ingress of undesirable micro-organisms. A need exists for means of preventing stress-cracking in plastic packages.

One aspect of irradiation is to treat the surface of fruits to reduce the count of micro-organisms on the surface of the fruit. This achieves an extension of shelf-life. This shelf-life could be further increased by employing packages which would control the respiration rate of the fruit. A need exists for the following information:

✓ The minimum oxygen level required by various fruits at temperatures ranging from 40° to 80° F. under various humidity conditions.

✓ The maximum tolerance level of the fruit for carbon dioxide at temperatures ranging from 40° to 80° F. under various humidity conditions.

✓ The effect of humidity level in promoting deterioration at temperatures ranging from 40° to 80° F.

A need exists for a low cost rigid container for irradiated foods which requires no exterior enamel and which will not impart metallic or foreign substances to the food.

A need exists for improved sealing methods for flexible containers which will provide hermetic seals even when the area to be sealed is contaminated with food, dust, fats, or moisture.)

- QMC - 189 -- Develop a composite can with a laminated body and metals ends. (To supplement the presently used metal cans having double-seamed ends, there is a need for a composite can, with body made of laminated paperboard, metal foil, and/or plastic, and ends made of metal. Present composite cans and methods of attaching metal ends do not produce a positive hermetic seal and result in a very weak area at the union of the body and ends of the can. The can must be capable of being hermetically sealed with the union of the ends and body being equal in strength to the body of the can.)

- QMC - 35 -- Formulate methods for determining the magnitude and number of impacts to which containers are subjected during shipment. (Despite several detailed studies of shock and vibration within rail cars, very little engineering information is available to aid the designer in his problem of producing a container to withstand such an environment. Additionally, transfer methods such as forklifts, bridge pallets, and hand loading present further hazards. Present test methods simulating these environments use arbitrary impact and vibration parameters which are without adequate foundation, in fact. To obtain adequate shipping data, a shock recorder of suitable size for insertion in standard size containers (e.g., No.'s 2, 2½ and 10 can size containers) is desirable. The recorder should be of an omnidirectional nature with a shock and frequency response level within the range of those encountered in shipment by normal modes of transportation.)

P U B L I C A T I O N C H E C K L I S T

- PEACEFUL USES OF NUCLEAR EXPLOSIONS; yes, there are such things. This document presents 151 references to literature on this subject, to October, 1961. (Report TID 3522 - 5th Rev. available through AEC channels, or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- SMALL BUSINESS INVESTMENT ACT; the latest text, with new safeguards, on this popular legislation often used to aid in the financing of growing technical organizations. 19 Pages. Single Copies Free. (Write Select Committee on Small Business, U. S. Senate, Washington 25, D. C. for "Small Business Investment Act - 1961")
- ATOMIC-HYDROGEN GUN; a 1961 revision of a Rand Corporation report for the Air Force on light-gas guns powered by electrical discharges, of value in studying hypervelocity impact phenomena. 45 Pages. (Report AD 260 770 available through military channels or at \$5.60 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- ICE CALORIMETERS; a technical report on the construction and calibration of two ice calorimeters. Includes results of high-temperature heat-content measurements on rubidium fluoride, hafnium tetrafluoride, cesium chloride and cesium iodide. 20 Pages. Single Copies Free. (Write U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigations No. 5832)
- PROJECT ECHO RADAR; a technical account of the radar employed at Bell Laboratories for tracking the Echo I communication satellite. 25 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, ATTN: CODE BID, Washington 25, D. C. regarding NASA Technical Note D-1135)
- PLASTICS FOR USE IN BUILDING; the proceedings of a 1960 conference on information requirements for selection of plastics used in the construction industry. 32 Pages. \$3. (Write Publications Office, National Academy of Sciences, Washington 25, D. C. for Publication No. 833)
- STOPPING POWERS FOR USE WITH CAVITY CHAMBERS; a critical review of available information concerning the so-called "stopping power" ratio that is used in the interpretation of cavity ionization measurements in radiation dosimetry. 85 Pages. 35 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for National Bureau of Standards Handbook No. 79)
- TITANIUM & TITANIUM ALLOY TECHNOLOGY; a review of developments in titanium metallurgy for the period June through August, 1961. 6 Pages. Single copies free to Government agencies, their contractors, subcontractors and suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio regarding DMIC Memorandum No. 126)
- NATIONAL METEOROLOGICAL SATELLITE PROGRAM; a report on progress in this field. 47 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for Report, Serial p, Meteorological Satellite Program)
- SELECTING MANUFACTURING SITE; a brief report from the Small Business Administration on some of the factors involved in selecting a site for a small manufacturing plant. Single Copies Free. (Write Service Department, Washington SCIENCE TRENDS, National Press Building, Washington 25, D. C. for MRS No. 43)
- LITHIUM; the first comprehensive U. S. Government report on this mineral which was almost unknown two decades ago and is now the basis of a multi-million dollar industry. 50 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Bureau of Mines Info. Circular No. 8053)

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